



# Tile-treatment Wetlands





**The Wetlands Initiative designs, restores and creates wetlands.  
We innovate, collaborate and employ sound science to improve water quality,  
habitat for plants and wildlife, and our climate.**



THE WETLANDS  
INITIATIVE



# Smart Wetlands



sited specifically to intercept subsurface drainage to remove nitrogen and phosphorus naturally,



a proven and common practice in multiple sectors (ag, industrial, municipal uses),



are a long-life practice (30+ years),



require little annual maintenance,



do not require cropping system changes,



qualify for USDA Farm Bill programs (EQIP IL CPS 656 or CRP CP39),



ancillary benefits – small storm storage, carbon sequestration, wildlife and pollinator habitat, recreational opportunities



SMART WETLANDS





# Smart Wetlands

Wetlands are **resilient ecosystems** (able to recover from disturbance) that are tolerant to changing water levels and provide sustainable nutrient removal processes.

In response to climate impacts and increased subsurface drainage, wetlands can provide **community resilience**.

- nutrient loss reduction
- flood storage
- reduced flood intensity
- drought
- water recharge
- storm buffering

SMART

**W** SMART WETLANDS





**TWI uses a 4-step process starting with engagement and outreach. Once we have an interested landowner or operator, we work as partners from design through implementation by offering free technical assistance and construction grants.**

**1. Engagement & Outreach**

**2. Free Assessment & Engineering Design**

**3. Farm Bill Program Coordination**

**4. Construction & Establishment**



# 2. Site Assessment

## A good site has:

- a tile system draining 30-200+ acres
- a tile main that is intercepted near the stream/ditch outlet or in a grassed waterway
- a wet or unprofitable area, but the site cannot be in a CWA jurisdictional wetland or a wetland under conservation compliance
- an upland (non-wetland) or prior converted farmland area with a grade (slope) to it
- soils capable of holding water (natural clay liner) and serving as a planting medium





# 2. Engineering Design

## Layout

- Prefer 3:1 length to width
- Longer distances = increased contact
- Berms/islands can achieve "length" in small spaces and improve circulation
- Deep zones improve sheet flow and disrupt short circuiting
- Straight lines versus a natural look

## Size

- Treatment area is 1-5% of the contributing drainage area (residence time)
- A size ratio of 2.5-5% recommended for >50% nitrate-nitrogen removal
- Treatment area doesn't include any embankments or buffer area
- If possible, eliminate surface runoff

## Soils

- Need at least a 12" clay liner on the bottom and up the sides to the treatment area depth to hold the water and to minimize seepage.
- Need loamy soils to serve as the growth media for the wetland plants. This is typically the 6-12 inches of topsoil that is scraped off and stockpiled prior to excavation.

## Depth

- Develop a shallow 12-24" (0.3-0.6 m) marsh ecosystem
- CP656 standard for the wetland treatment area is no more than 2' below normal pool with 50% of the area having 12" or less of water.
- Manage water levels with water control structure and auxiliary spillway
- Provides best conditions for nitrate-nitrogen removal
- Promotes emergent wetland vegetation
- Not appropriate for fish habitat





# Size

- Treatment area is 1-5% of the contributing drainage area (residence time)
- A size ratio of 2.5-5% recommended for >50% nitrate-nitrogen removal
- Treatment area doesn't include any embankments or buffer area
- If possible, eliminate surface runoff

# Layout

- Prefer 3:1 length to width
- Longer distances = increased contact
- Berms/islands can achieve "length" in small spaces and improve circulation
- Deep zones improve sheet flow and disrupt short circuiting
- Straight lines versus a natural look



# Depth

- Develop a shallow 12-24" (0.3-0.6 m) marsh ecosystem
- CP656 standard for the wetland treatment area is no more than 2' below normal pool with 50% of the area having 12" or less of water.
- Manage water levels with water control structure and auxiliary spillway
- Provides best conditions for nitrate-nitrogen removal
- Promotes emergent wetland vegetation
- Not appropriate for fish habitat

# Soils

- Need at least a 12" clay liner on the bottom and up the sides to the treatment area depth to hold the water and to minimize seepage.
- Need loamy soils to serve as the growth media for the wetland plants. This is typically the 6-12 inches of topsoil that is scrapped off and stockpiled prior to excavation.



# 3. Farm Bill Programs

- Technical and financial assistance available through NRCS or FSA
- Environmental Quality Incentives Program (EQIP) – CPS 656
- Conservation Reserve Program (CRP) – CP39 under the Farmable Wetlands Program

We work with you and NRCS/FSA to complete the required paperwork and get design approval.

**W** SMART WETLANDS



United States Department of Agriculture

Natural Resources Conservation Service  
CONSERVATION PRACTICE STANDARD  
CONSTRUCTED WETLAND  
CODE 656  
(ac)

for biological treatment of water.

G656-1

NATURAL RESOURCES CONSERVATION SERVICE - ILLINOIS  
CONSERVATION PRACTICE GUIDANCE  
656 – CONSTRUCTED WETLAND  
Cropland Drainage Water Treatment

## I. SCOPE

A constructed wetland may be used to treat water from a variety of different sources, including wastewater and contaminated runoff from livestock facilities, stormwater runoff and other water flows. The guidance in this document refers specifically to the treatment of drainage water from cropland.

In Illinois, the primary goal for installing constructed wetlands to treat drainage water from cropland is to reduce nitrate loading in receiving surface waters.

## II. CRITERIA

All applicable criteria in Conservation Practice Standard 656 – Constructed Wetland must be met. The following criteria are for constructed wetlands:

with soil drainage group A plus ½ of the watershed acres in soil drainage group B. The constructed wetland must be located such that the flow line of the subsurface tile(s) supplying drainage flow to the wetland is at least 12" above the proposed permanent pool of the wetland.

The treatment pool area of the constructed wetland should be at least 1% of the size of the contributing watershed.

- The contributing watershed is drained by the tile system discharging into the treatment pool plus a portion of the contributing acres of surface water entering the treatment pool.
- Treatment pool area is 2% of the contributing watershed area and is 12" above the design permanent wetland pool elevation.
- Areas that will be deeper than the design permanent wetland pool are not counted when computing the treatment pool area.



# 4. Construction

- Develop cost estimates
- Assist with contract bids
- Provide construction oversight







## 4. Wetland Vegetation

Established by natural regeneration, seeding, and/or plug planting





## Seeded or Planted Wetland Species

*Sagittaria latifolia* (arrowhead)

*Schoenoplectus pungens* (common threesquare)

*Spartina pectinata* (prairie cordgrass)

*Juncus effusus* (common or soft rush)

*Schoenoplectus acutus* (hardstem bulrush)

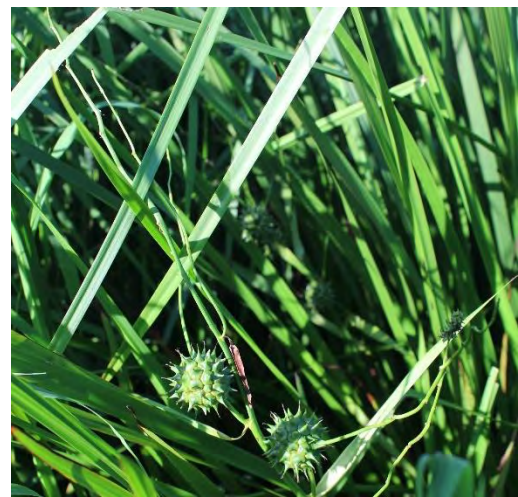
*Schoenoplectus tabernaemontani* (softstem bulrush)

*Scirpus atrovirens* (dark green rush)

*Sparganium eurycarpum* (giant bur-reed)

*Alisma subcordatum* (common water plantain)

*Carex stricta* (tussock sedge)





# Treatment Wetland Inhabitants and Visitors

## Mammals

- Beaver
- Muskrat
- River Otter
- Deer

## Birds

- Migratory waterfowl
- Shorebirds
- Wading birds
- Game birds

## Amphibians

- Turtles
- Frogs
- Toads
- Salamanders

## Insects

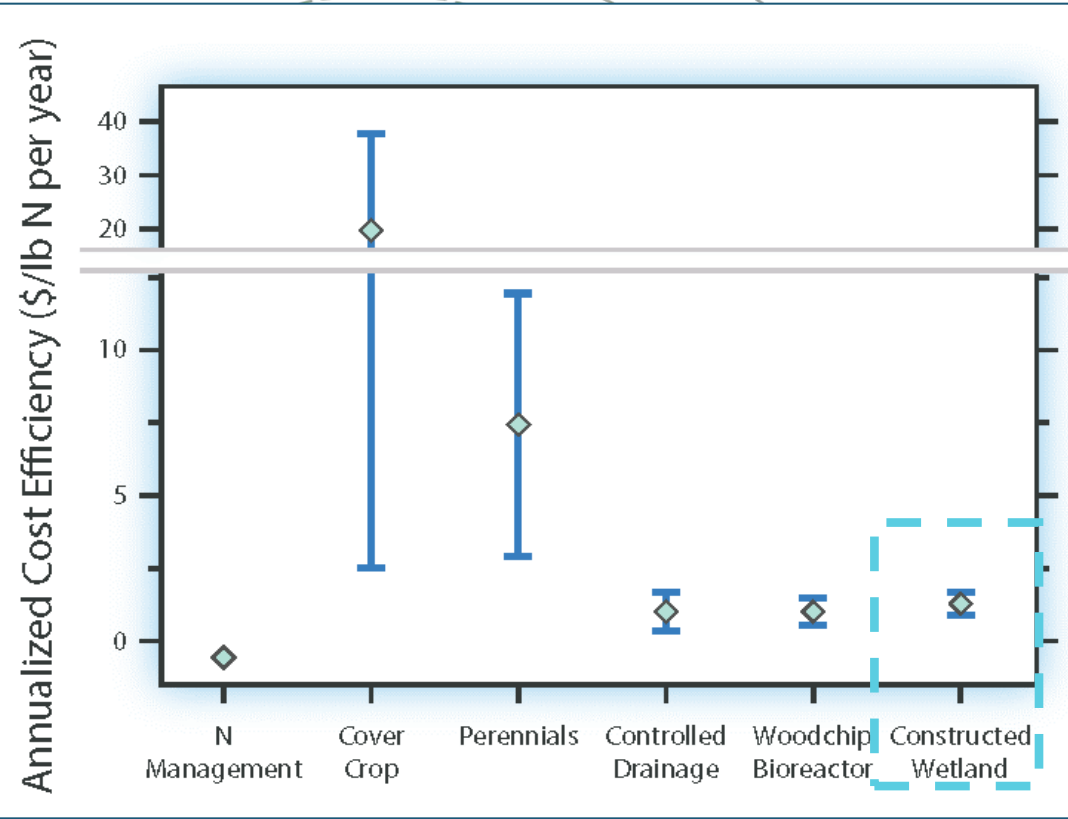
- Dragonflies and Damselflies
- Beetles
- Pollinator species



Photo credit: Tim Lindenbaum

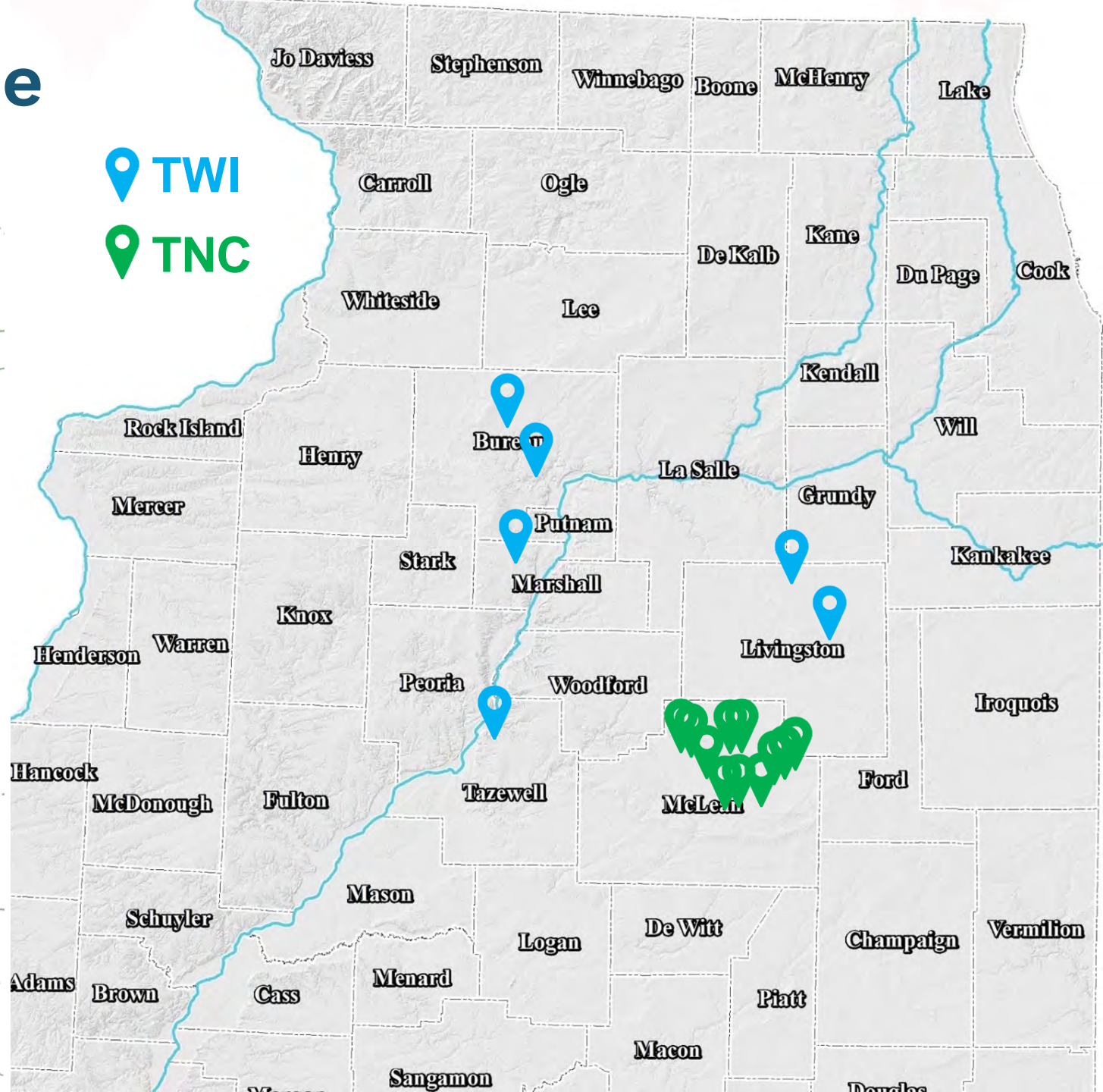


# Wetland Performance



(Christianson et al., 2016)

📍 TWI  
📍 TNC



W SMART WETLANDS





# Wetland Performance

To demonstrate how well Smart Wetlands function, we partnered with researchers to collect several years of data at our first two Smart Wetlands in Bureau County, IL.

We collected the following data:

- weather (rain, temperature, wind, etc.)
- water flow rate
- nitrogen constituents
- phosphorus constituents
- tracer studies (hydraulic residence time)
- sediment organic matter content
- microbial community composition



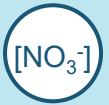


# Smart Wetland Performance

Main factors affecting nutrient removal



Tile Flow



Nutrient Concentration



Residence Time

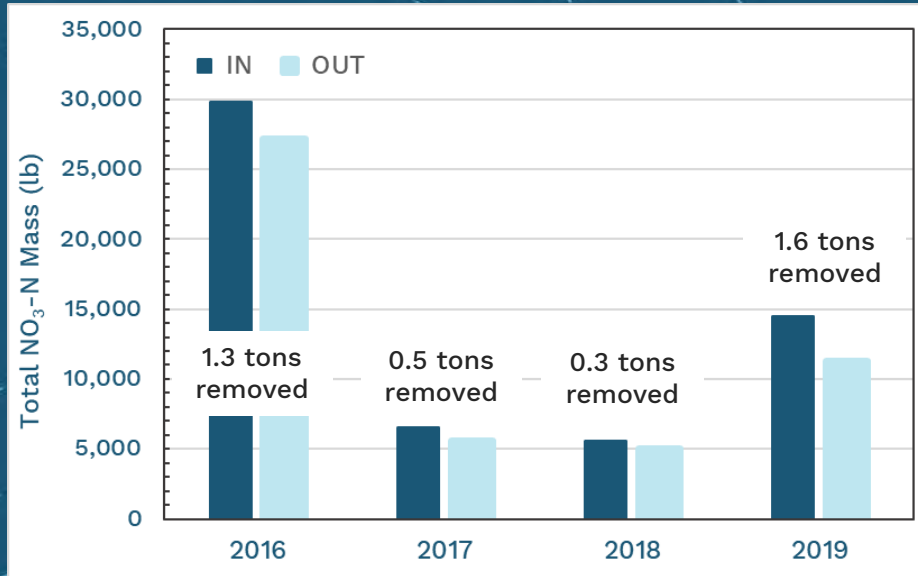


Water & Soil Temperature



Carbon for Microbes

## Bureau County SW1: Nitrate-Nitrogen



**0.7 acre wetland (0.3% size ratio):**

- Annual Removal Efficiency was 9-69% (Avg 20%)
- Total Removal was **3.6 tons nitrate-N** over 4 years
- Average removal per year is 2,750 lb/acre of wetland

## Bureau County SW2: Nitrate-Nitrogen



**0.8 acre wetland (3.6% size ratio):**

- Annual Removal Efficiency was 66-81% (Avg 80%)
- Total Removal was **12.2 tons nitrate-N** over 3 years
- Average removal per year is 10,000 lb/acre of wetland



# Bureau County Wetland #1



Near Ohio, IL

Treats ~230 acres

4.3-acre buffer &  
wetland

0.7-acre treatment  
wetland

Built 2015



# Bureau County Wetland #2

Near Princeton, IL

Treats 22 acres

4.9-acre buffer &  
wetland

0.8-acre treatment  
wetland

Built 2016





# Livingston County Wetland #1

Near Saunemin, IL

Treats 73 acres

4.5-acre buffer &  
wetland

1.1-acre treatment  
wetland

Built 2018



**W** SMART WETLANDS



# Illinois Central College Wetland



East Peoria, IL

Treats 40 acres

4.2-acre buffer &  
wetland

0.9-acre treatment  
wetland

Built 2019

**W** SMART WETLANDS



# Marshall County Wetland #1

Near Henry, IL

Treats 60 acres

7.3-acre buffer &  
wetland

1.8-acre treatment  
wetland

Built 2021





# Livingston County Smart Wetland #2



Near Dwight, IL

Treats 75 acres

12.3-acre buffer & wetland

1.3-acre treatment and 0.6-acre restored wetlands

Built 2022

**W** SMART WETLANDS



# Why choose to install a tile-treatment wetland?

“I like to follow the science. The thing I like best about the tile-treatment wetland is that you guys (TWI) had the research and you showed me that these wetlands work well to remove nitrate. So, I know that it works.” – Farm Operator, Marshall County Wetland #1



## SMART WETLANDS

We use a 4-step process starting with engagement and outreach. Once we have an interested landowner or operator we work as partners from design through implementation by offering free technical assistance and construction grants.

1. Engagement & Outreach

2. Free Assessment & Engineering Design

3. Farm Bill Program Coordination

4. Construction & Establishment

### 2. Site Assessment

A good site has:

- a tile system draining 20-500 acres
- a tile main that be intercepted near the stream/ditch, but is in a grassed waterway
- a wet or unproductive area but the site cannot be in a water jurisdiction, wetland or a wetland under conservation easement
- an upland (non-wetland) or grass-covered farmland area with a good (shallow) soil
- soils capable of holding water (medium clay loam and silty clay loam are best)

### 2. Engineering Design



### 4. Wetland Design

The wetland should be designed to intercept the tile main and provide a grassed waterway for the water to flow into. We will work with you to design the wetland to meet your needs.

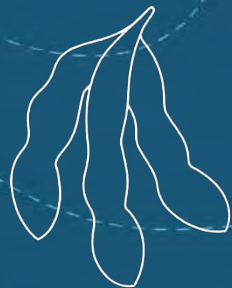


W

# SMART WETLANDS

Jean McGuire  
Field Outreach Specialist  
[jmcguire@wetlands-initiative.org](mailto:jmcguire@wetlands-initiative.org)

Jill Kostel, Ph.D.  
Senior Environmental Engineer  
[jkostel@wetlands-initiative.org](mailto:jkostel@wetlands-initiative.org)



W

[www.smartwetlands.farm](http://www.smartwetlands.farm)

Instagram: [smartwetlands](https://www.instagram.com/smartwetlands)

Twitter: [@smartwetlands](https://twitter.com/smartwetlands)





THE WETLANDS  
INITIATIVE

333 N. Michigan, Suite 628

Chicago, IL 60601

(312) 922-0777

[www.wetlands-initiative.org](http://www.wetlands-initiative.org)

*This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under agreement number 2022-38640-37486 through the North Central Region SARE program under project number LNC22-465. USDA is an equal opportunity employer and service provider. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.*